

# METHOD AND APPARATUS FOR BOUNDING THE SOLUTION SET OF A SYSTEM OF LINEAR EQUATIONS

## ABSTRACT

One embodiment of the present invention provides a system that bounds the solution set of a system of nonlinear equations specified by the set of linear equations  $\mathbf{Ax} = \mathbf{b}$ , wherein  $\mathbf{A}$  is an interval matrix and  $\mathbf{b}$  is an interval vector. During operation, the system preconditions the set of linear equations  $\mathbf{Ax} = \mathbf{b}$  by multiplying through by a matrix  $\mathbf{B}$  to produce a preconditioned set of linear equations  $\mathbf{M}_0\mathbf{x} = \mathbf{r}$ , wherein  $\mathbf{M}_0 = \mathbf{BA}$  and  $\mathbf{r} = \mathbf{Bb}$ . Next, the system widens the matrix  $\mathbf{M}_0$  to produce a widened matrix,  $\mathbf{M}$ , wherein the midpoints of the elements of  $\mathbf{M}$  form the identity matrix. Finally, the system uses  $\mathbf{M}$  and  $\mathbf{r}$  to compute the hull  $\mathbf{h}$  of the system  $\mathbf{Mx} = \mathbf{r}$ , which bounds the solution set of the system  $\mathbf{M}_0\mathbf{x} = \mathbf{r}$ .